5b) RRRGGGGG

green chair on either end

G _ _ _ _ _ _ G

Ways = $1 \times \frac{6!}{3!3!}$ OR $\frac{{}_6P_3 \times 5!}{3!5!}$

↑ G at either end

7c) Socks

S S S S S

S S S (6)

S S

Ways = 6 × 3!
= 36

d) K left of C

Ways = $\frac{5!}{2!} \div 2$

9d) DECISIONS

Number of D = $\frac{9!}{2!2!} \div 2$

11

a) Ways $= 2^{10}$

b) 1st/last Y $= 1 \times 1 \times 2^{8}$

c) 2Y, 8N $= \frac{10!}{2!\,8!}$

d) 5Y, 5N $= \frac{10!}{5!\,5!}$

e) ≥ 7 Y $= \frac{10!}{8!\,2!} + \frac{10!}{9!} + \frac{!}{10!}$

(8!2! → 8Y, 9! → 9Y, 10! → 10Y)

11f) odd Y's $= 10 + \frac{10}{3!7!} + \frac{10}{5!5!} + \frac{10}{7!3!} + \frac{10}{9!}$

g) 3Y's together $= \frac{8!}{7!}$

(YYY), 7N

h) 1st/last Y and exactly 4 more Y $= 1 \times \frac{8!}{4!4!}$

11

e)

$$>7Y = 8Y + 9Y + 10Y$$

$$= \frac{10!}{8!2!} + \frac{10!}{9!} + 1$$

$$= \underline{\underline{56}}$$

f) odd $*Y = 1Y + 3Y + 5Y + 7Y + 9Y$

$$= 2(1Y + 3Y) + 5Y$$

$$= 2\left(\frac{10!}{9!} + \frac{10!}{3!7!}\right) + \frac{10!}{5!5!}$$

12b) max 3Y
2G
1P

a) 6 dots = $\frac{6!}{3!2!}$

b) 5 dots.

13/ STRESS

① if S is left out

TRESS

$\frac{5!}{2!}$

② not S left out

SRESS

$3 \times \frac{5!}{3!}$

$\text{Total} = \frac{5!}{2!} + 3 \times \frac{5!}{3!}$

$= 120$

13b) BANANA

5 letter words = $\frac{5!}{2!3!} + \frac{5!}{2!2!} + \frac{5!}{3!}$

4 letter words = $\frac{4!}{2!2!} + \frac{4!}{3!} + \frac{4!}{2!} + \frac{4!}{2!} + \frac{4!}{3!}$ = 38

AA NN

ADAM

3 letter words = $\frac{3!}{1!} + \frac{3!}{2!} + \frac{3!}{2!1}$

= 12

15 TRANSITION

c) I's, N's, T's together - 7!

$$\frac{6!}{2!\,2!\,2!} \times 5!$$

15c) TRANSITION

N's occupy end position

$$= 1 \times \frac{8!}{2!2!}$$

15e) TRANSITION

N first and NOT last

$$= 1 \times 8 \times \frac{8!}{2!2!}$$

1st N 2nd N

15th TRANSITION

N is NOT at either end.

$$= \frac{{}^{8}P_{2}}{2!} \times \frac{8!}{2!2!}$$

15f, TRANSITION

Ways = 453600 (part c) no restrictions) − 10080 (d) both hands) − 2×80640 (e) 1st not last)

= 282240.

15g TRANSITION

vowels together = $\frac{4!}{2!} \times \frac{7!}{2! \cdot 2!}$

$\frac{4!}{2!}$: arranging vowels

$\frac{7!}{2! \cdot 2!}$: arrange 6 consonants and 1 group

17

R R B B G G Y Y

no two identical shirts are together.

No restrictions $= \frac{8!}{2!2!2!2!}$

RR $- \frac{7!}{2!2!2!} \times 4$

RR BB $+ \frac{6!}{2!2!} \times {}^4C_2$

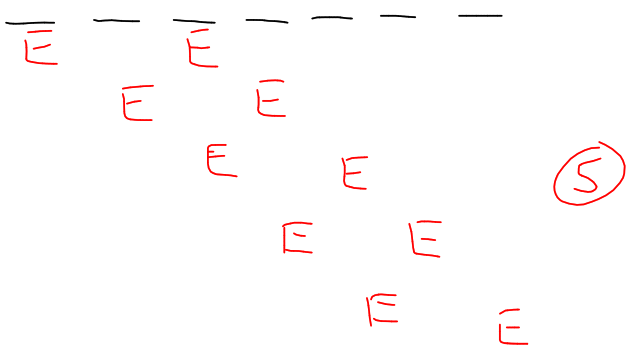
RR BB GG $- \frac{5!}{2!} \times {}^4C_3$

RR BB GG YY $+ 4!$

$= 864$

18/ GUMTREE

c) (i) E's separated by one letter $= 5 \times 5!$



18d) GUMTREE

G is between the two E's. $= 35 \times 4!$

_ _ _ _ _ _ _

E G E (5 ✓) — 1×5

E _ G E (4 ✓) — 2×4

E _ _ G E (3 ✓) — 3×3

E _ _ _ G E (2 ✓) — 4×2

E _ _ _ _ G E (1 ✓) — 5×1

35

18e) GUMTREE

M is to left of E's, U is somewhere between.

35 x 3!

M ①	M ②	M ③	M ④
1 x 4	1 x 3	1 x 2	1
2 x 3	2 x 2	2 x 1	
3 x 2	3 x 1		
4 x 1			
20	10	4	1

18.

GUMTREE

G left of U, M right of U $= 35 \times \frac{4!}{2!}$

G	U	M	M	M	M	M	5
G	G	U	M	M	M	M	2 × 4
							3 × 3
							4 × 2
							5 × 1
							35

19

GUMTREE KOALA

KOALA must appear in that order

$$\text{Ways} = \frac{12!}{2!\,2!} \times \frac{2!}{5!}$$

÷ by arrangements of KOALA

$=$